Remarks

Status of the Claims

Claims 1 – 20 were original in the application. Claim 20 was withdrawn and cancelled without prejudice. Claims 1 – 4, 18, and 19 were previously cancelled. Claims 5, 6, 11, and 16 have been currently amended. Claims 21 – 23 have been added. Therefore, claims 5 – 23 are submitted as being set forth in allowable form.

Rejection Pursuant to 35 US.C. 112

Claim 5 has been responsively amended.

Rejection Pursuant to 35 USC § 103

Claim 5 was rejected as obvious over Hollis et al. US. Patent 5,653,939 in view of Wainright US. Patent 6,306,273. The Examiner contended that Hollis teaches an apparatus comprising: an integrated microfluidic peristaltic pump (PI); a plurality of analysis chambers (wells 42 formed in each test site 12' contained in array 10) in communication with the pump; and a plurality of analysis devices (i.e., a micromechanica1 resonator, surface acoustic or electromagnetic wave detector, or a monolithically integrated charge-coupled device (CCD), etc.), which test a fluid contained within the analysis chambers for an analyte (see col. 4, line 15 - col. 15, line 51; figures 1 - 6, 18 & 19).

The Examiner admitted that Hollis is silent with respect to any teaching

relating to the incorporation of an integrated LED. Hollis was cited to teach the incorporation of an integrated optical detector, such as a monolithically integrated charge-coupled device (CCD) (see col. 8, lines 59 - 67). Hollis was also cited to teach the incorporation of a laser light source (416') for laser scanning of the test sites (see col. 14, lines 33 - 50).

In addition, the Examiner contended that a Court has held that the use of a one-piece, integrated construction instead of the structure disclosed or taught in the prior art would have been within the ambit of a person of ordinary skill in the art. See *In re Larson,* 340 F.2d 965,968, 144 USPQ 347, 349 (CCPA 1965) (see MPEP § 2144.04).

Claim 5 has been amended to refer generally to analysis devices without limitation. The reference to Wainright is no longer relevant. Claim 5 is directed to an apparatus which is manufactured in a single substrate. Fig. 19 of Hollis clearly shows the detection array 12' made in a separate chip from the substrate in which the pump P1 is made. Array 12' is connected across a cavity in the substrate by means of a sealing O-ring 345. Hollis is not an integrated device but an assembled collection of components. The Examiner cites *In re Larson* as authority for the proposition that all integrated structures are equivalent to component assembled structures. Aside from the fact that integration of devices has led to thousands of major and significant advances in the 20th century, *In re Larson* was concerned with the use of the word, "integral" in a claim 12 for vehicle brake. Claim 12 was:

> 12. In a vehicle, a wheel hub having annular rim flanges, each flange having an annular clamping seat, a flexible-walled casing having beads

> engaged with the respective seats, clamping means fastened to the respective rim flanges in clamping engagement with said beads to hold said beads to said seats to form a fluidtight fluid cargo enclosure bounded by said wheel hub and said flexible-walled casing, and frictional brake means, said means **including a brake drum integral with a said clamping means**, whereby to transmit heat from the brake drum to said wheel hub for transmission to a fluid cargo disposed within said fluid-tight enclosure.(emphasis added)

The Court in that case found the essential difference between the prior art construction and that of claim 12 is the manner of connecting the brake disc or drum to the wheel hub. The Court stated:

> While the term "integral" is not limited to a fabrication of the parts from a single piece of metal, but is inclusive of other means for maintaining the parts fixed together as a single unit. While the brake disc and clamp of [the prior art] comprise several parts, they are rigidly secured together as a single unit. The constituent parts are so combined as to constitute a unitary whole. Webster's New International Dictionary (Second Edition) defines "integral" as "(2) Composed of constituent parts making a whole; composite; integrated." We are inclined to agree with the board's construction of the term "integral" as used in claim 12. Then, too, we are inclined to agree with the position of the solicitor that the use of a one piece construction instead of the structure disclosed in [the prior art] would be merely a matter of obvious engineering choice. (parenthetical matter added)

One piece construction of brake parts verses integral construction of the same brake parts is not analogous to integrated microfluidic and electronic construction of devices, which ordinarily cannot be made because of incompatible integrated manufacturing processes. The nature of materials and processes usable with microfluidic mechanical devices, such as peristaltic pumps and the nature of materials and processes usable with electronic probes or analysis devices are different and incompatible, resulting in the necessity for the component construction of Hollis. With the claimed combination this incompatibility is

overcome. How to overcome this seeming inherent incompatibility does not in any sense flow from Hollis. There is mention of PEC techniques for pump manufacturing, no mention of nitride processes for forming analysis devices, and no description of what the pump is made out of or how it is made, let alone a choice of a GaN peristaltic micropump in Hollis.

Claims 6 - 8, 11 - 13, 16 and 17 were rejected as being obvious over Hollis in view of Lisee US. Patent 6,655,923. Regarding claims 6, 7 and 11 - 13, the Examiner cited Hollis as teaching an apparatus comprising: an integrated micro fluidic peristaltic pump (PI); a plurality of analysis chambers (wells 42 formed in each test site 12' contained in array 10) in communication with the pump; and a plurality of analysis devices (i.e., a micromechanical resonator, surface acoustic or electromagnetic wave detector, or a monolithically integrated charge-coupled device (CCD), etc.), which test a fluid contained within the analysis chambers for an analyte; (see co!. 4, line 15 - co!. 15, line 51; figures 1 - 6, 18 & 19). The Examiner admitted that Hollis did not specifically teach the incorporation of a micropump comprising the characteristics as recited. Lisec was cited as teaching a micropump apparatus comprising: an electrodeformable membrane (denoted by 2,5 and 6); a fixed substrate (1); a microchannel or cavity (e.g., the volume indicated by numeral 17); an electrode structure (3 and 4); and associated pillar-shaped contact pads (7) (see col. 4, lines 35 - 67; figures la, 5, 6a and 6b). The Examiner contended that it would have been obvious to recognize the suitability of incorporating the micropumps disclosed by Lisec with

a micro fluidic analysis system for the same intended purpose of facilitating effective fluid transport and therefore sample processing and analysis (see MPEP § 2144.07). The Examiner contended that both Hollis and Lisec disclose the use of micropumps with analytical micro fluidic devices, which are considered functionally equivalent (see MPEP § 2144.06). The Examiner cites one opinion for the proposition that an express suggestion to substitute one equivalent component or process for another is not necessary to render such a substitution obvious. See *In re Fout,* 675 F.2d 297, 213 USPQ 532 (CCPA 1982). Therefore, it would have been obvious to incorporate the disclosed micropump with the analytical detection system in order to facilitate effective sample processing and analysis.

Claims 6, 11 and 16 are distinguished from Hollis and LIsec for the same reasons as claim 1. Lisec's disclosure of peristaltic pumps is cumulative to Hollis. Lisec discloses only the choice of a silicon membrane and is irrelevant to claims 6, 11 and 16 as amended. The Examiner admits that neither Hollis nor Lisec teach the incorporation of gallium nitride materials for use as an electrodeformable membrane let along integration of such a pump with nitride-process compatible integrated electronic elements.

Claims 7 and 8 depend directly or indirectly on claim 6, claims 12 and 13 depend directly or indirectly on claim 11, and claim 17 depends on claim 16 and are allowable therewith for such further limitations as set forth therein.

Claims 9, 10, 14 and 15 were rejected as being obvious over Hollis and

Lisec, as applied to the claims above, and further in view of Purdy US. Patent 6,177,057. The Examiner admitted that neither Hollis nor Lisec teach the incorporation of gallium nitride materials for use as an electrodeformable membrane. The Examiner contended that based on Purdy, the use of gallium nitride materials in the fabrication of microfluidic devices are well known in the art and that gallium nitride materials are recognized to have high mechanical stability and a large piezoelectric constant (see col. 1, lines 10 - 19). These material properties are desirable in a material to be used as an electrodeformable membrane. The Examiner contends that it would have been obvious to recognize the suitability of using gallium nitride materials in an application involving electromechanical deformation, such as for an electrodeformable membrane. Therefore, the Examiner asserts that it would have been obvious to incorporate the use of gallium nitride materials as an electrodeforrnable membrane with the disclosed apparatus as claimed.

Turn and consider however, what Purdy actually teaches in regard to GaN. At the cited col. 1, lines 10 – 31, it is stated:

> Gallium nitride has been considered a promising material for semicondutor {sic} devices since about 1970, especially for the development of diodes for emitting blue light and ultraviolet light. Gallium nitride is a candidate material for optoelectrical applications at such photon energies because it forms a continuous alloy systems InGaN and AlGaN. Other advantageous properties for this material include high mechanical and thermal stability, large piezoelectric constants and the possibility of passivation by forming thin layers of Ga.sub.2 O.sub.3 with a bandgap of 4.2 eV. *The spontaneous and piezoelectric polarization in wurtzite materials and the high electron drift velocity of $2x10^5$ m/s can be used to fabricate high power transistors based on AlGaN/GaN heterostructures.* For epitaxial growth of gallium nitride by the non-bulk procedure of molecular beam epitaxy it is necessary to supply nitrogen as a molecular beam. Although epitaxial growth of gallium nitride on sapphire and silicon substrates by

> gas-source molecular beam epitaxy using ammonia has been reported, gallium nitride does not grow on gallium arsenide when ammonia is used, and the nitridation of gallium arsenide surfaces by more active nitrogen sources is suggested for epitaxial growth of gallium nitride on gallium aresnide.

The only mention of any piezoelectric property is in regard to piezoelectric polarization in wurtzite materials and use in high power transistors based on AlGaN/GaN heterostructures. What Purdy motivates is to use GaN in transistors, which has been known in any case since 1970. There is no mention for use for membranes. However, even if there were such a suggestion, the use in membranes is a **reverse piezoelectric** effect. No suggestion is made regarding *reverse piezoelectricity* of GaN. Further, even if that suggestion were made, its use for an integrated nitride-process compatible analysis sensor and pump in the same integrated microfluidic/electronic apparatus stretches the "nonteachings" of Purdy beyond credibility and makes the rejection a hindsight revisionist reconstruction of the technology.

Claims 9, 10, 14 and 15 relate to certain doping types for the GaN for different portions of the pump to which Purdy is totally mute and devoid of teaching.

Advancement of the claims as amended to allowance is respectfully requested.

Respectfully submitted,

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